

# Reducing Risk of Damage During Wet-mating Connectors via ROV

## Teledyne ODI

### Background

BP had experienced issues with connector damage due to ROV operator intervention. ROV pilots who were not well acquainted with optical wet-mate connectors were causing damage to them due to exceeding the operating envelope of the connectors. BP approached Teledyne to develop a solution to the problem and mitigate risks caused by ROV pilot intervention.

### What were the project challenges?

The initial challenge was to understand the issues more completely. This entailed reviewing many hours of ROV camera footage to determine some areas for improvement. Additionally, a detailed analysis, was performed of connectors that had been damaged and returned from the field. These analyses coupled with many team meetings between Teledyne and BP quickly focused the solution into several areas — the need for changes to the O/I manual which included pictures for inspecting the wet-mate connectors before mating, training of field personnel who use optical wet-mates, and the advent of the GAF/ELI (Gross Alignment Funnel/Enhanced Latch Indicator).

### What were the innovative technical solutions available to the project team?

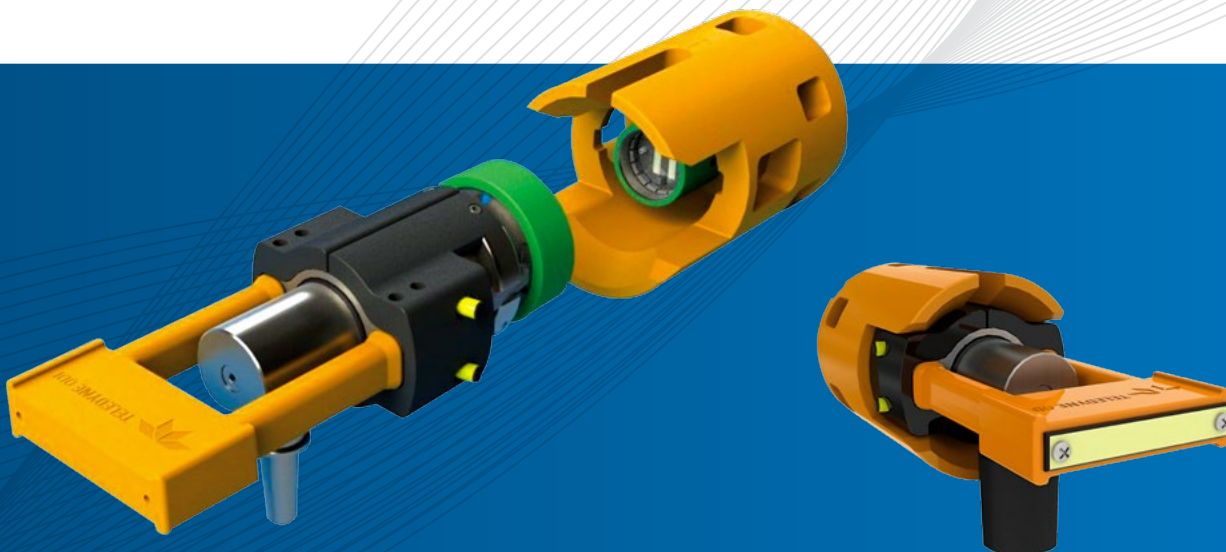
There were no alternate solutions considered, the GAF/ELI was determined to solve the alignment of the connectors and provide enhanced determination of connector latching.

Interconnect

**Product:**  
Optical and Electrical  
Wet-mate

**Application:**  
Subsea Power and  
Data Networks

**Client:**  
BP



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### What was the final engineered technical solution?

**ELI:** The engineered technical solution included a field retrofit kit of hardware that could be attached to the flying lead connector by service personnel. The installed kit includes a set of buttons which pop out of the connector in close proximity to the handle upon successful mating completion. The ELI kit also provides an alignment guide for the flying lead into the GAF attached to the bulkhead.

**GAF:** The engineered technical solution included a precision alignment guide which can be retrofit installed to a bulkhead connector by service personnel. This funnel guide prohibits approach angles of greater than 4 degrees between connector faces during mating, even if the incidence angle between the connectors is much greater during ROV approach (30 degrees).

### What were the benefits of selecting this particular approach/solution?

Damage risk mitigation is the main benefit. A single damaged connector can cause millions of dollars in needed rework. A secondary benefit is with the time it takes to make up a connector set. Times in excess of 45 minutes have been witnessed in the field without the GAF/ELI. The GAF/ELI reduces the time to make-up these connectors to less than 10 typically.

### Customer Quotes on Solution:

*Taken from BP e-mail:* With millions of dollars spent on intervention caused by connector failures and to support the Root Cause Analysis performed on the electro-optical connectors in 2009, a TRAP was conducted in May 2010 to review the design improvements ODI initiated to improve the failures and reduce the occurrence of damages to connectors during ROV mate and de-mate subsea. The team raised 24 actions with 4 interface Project actions based on observations. All actions have been closed. The final report can be shared upon request.

#### Gross Alignment Funnel (GAF):

- With three available designs (electrical, optical and MCDU) and designed to be mounted on bulkheads connectors, GAF creates alignment during mate and de-mate with flying lead connector much easier with a maximum 5 degrees mis-alignment and 10 degrees rotation.
- Mating after a side load test of 1000 lbs in -40C proved to be successful.

#### Enhanced Latch Indicator (ELI):

- Enhances visibility to indicate proper mating of the flying lead connector to the bulkhead connector half.
- ELI is positioned closed to the ROV handle to provide high visibility indication. Field retrofitable.

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### Highlight:

Teledyne ODI reviewed customer feedback on the potential damage to wet-mate connectors during mating operations, then developed an accessory product, the GAF/ELI, to simplify mating operations and reduce mating time.

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